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Estimation of coho salmon escapement in the Ugashik lakes, Alaska Peninsula National Wildlife Refuge, Alaska, 2002

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Alaska Fisheries Data Series Number 2003-3

Estimation of coho salmon escapement in the Ugashik lakes, Alaska Peninsula National Wildlife Refuge, Alaska, 2002

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Abstract. - From 26 July to 24 September 2002, hourly counts were conducted from counting towers to estimate the escapement of coho salmon *Oncorhynchus kisutch* into the Ugashik lakes. Estimated escapement for the season was 17,730 coho salmon and daily escapement estimates ranged from -18 on 20 September to 1,494 on 25 August. A total of 66 coho salmon was sampled for biological data. Three age classes were identified; age 2.1 dominated the sample (71%), followed by age 1.1 (27%), and age 3.1 (2%). Estimated male to female ratio was 1.5:1 and mid-eye to fork lengths ranged from 452 to 663 mm. The estimated escapement of other Pacific salmon during the same time period was 21,270 sockeye salmon *O. nerka*, 912 chum salmon *O. keta*, 132 chinook salmon *O. tshawytscha* and 714 pink salmon *O. gorbuscha*.

INTRODUCTION

Coho salmon *Oncorhynchus kisutch* is an important subsistence species for the residents of Ugashik and Pilot Point (Wright et al. 1985). A significant portion of the coho salmon harvested by local subsistence users is taken from the Ugashik lakes, located within the Alaska Peninsula National Wildlife Refuge (Wright et al. 1985). In-season salmon escapement monitoring in the Ugashik Commercial Management District is focused mainly on sockeye salmon *O. nerka*. The Alaska Department of Fish and Game (ADFG) does monitor the catch and harvest of coho salmon from commercial, subsistence, and sport fishing. However, this information is compiled after the subsistence fishery is over and therefore, does not provide an estimate of in-season run strength. Current in-season management of coho salmon is based on catch/effort indices from the commercial fishery. (Keith Weiland, ADFG Personal Communication) and escapement is indexed post-season from a single aerial survey (Glick et al. 2000).

The 2001 commercial harvest of coho salmon in the Ugashik Commercial Management District was 1,030, well below the ten-year average of 15,074 (Sands et al. 2002). In 2001, an estimated 357 coho salmon was harvested by subsistence users in the Ugashik district, slightly lower than the ten-year average of 421 (Sands et al. 2002). In 1998, sport anglers harvested 263 coho salmon (Howe et al. 1999), also below the ten-year average of 451 fish. Estimates of the commercial, subsistence, and sport harvest however, are made for broad geographic areas rather than specific rivers or lakes. For example, sport harvest information

reported for the Ugashik system encompasses the King Salmon, Dog Salmon, and Ugashik drainages (Howe et al. 1999). During the summer of 1998, the ADFG and the U. S. Fish and Wildlife Service (USFWS) conducted a creel census at the Ugashik Narrows (Figure 1), and documented a catch of 177 and harvest of 44 coho salmon (Jaenicke and Squibb 2000).

The need for an in-season escapement estimate was demonstrated during the 2000 fishing season when ADFG Sport Fish received numerous phone calls demanding regulatory action because of poor coho salmon fishing success by sport anglers (Dan Dunaway, ADFG Personal Communication). Concerns of a lack of coho salmon were also voiced by the subsistence fishery users outside of the Conservation Unit boundary (Anonymous Ugashik Village subsistence fisher, Personal Communication). Because commercial fishing success was in the acceptable range early in the season (Keith Weiland, ADFG Personal Communication) no action was taken to close the fisheries.

Subsistence users are concerned that the lack of an in-season estimate of coho salmon escapement may allow the sport fishery to over harvest the population. Representatives from Ugashik Traditional Village, Bristol Bay Native Association (BBNA), and King Salmon Fishery Office (KSFO) discussed solutions to the lack of escapement information for coho salmon and the subsistence/sport fishing conflict. An agreement was reached that the first step toward resolving the conflict would be to obtain an accurate estimate of escapement. The parties agreed that the best way to evaluate escapement would be to extend the operation of the ADFG sockeye salmon counting tower through the coho salmon season.

In-season escapement information could have improved the decision making process and provided better conservation security for the coho salmon population. Also, an in-season estimate of escapement would ensure that a sufficient number of coho salmon is available for subsistence harvest. An accurate post-season escapement estimate may diminish concerns about over-harvest and will help in resolving the conflict between subsistence and sport users. The information provided by this project will aid the Bristol Bay Regional Advisory Council and the Federal Subsistence Board in evaluating regulatory proposals regarding management of coho salmon stocks in the Ugashik lakes drainage. The specific objectives for the project were:

1. Estimate daily and seasonal escapement of coho salmon in the Ugashik lakes.

2. Estimate the age and sex compositions of coho salmon such that simultaneous 90% confidence intervals have a maximum width of 0.20.

3. Estimate the mean length of coho salmon by age and sex.

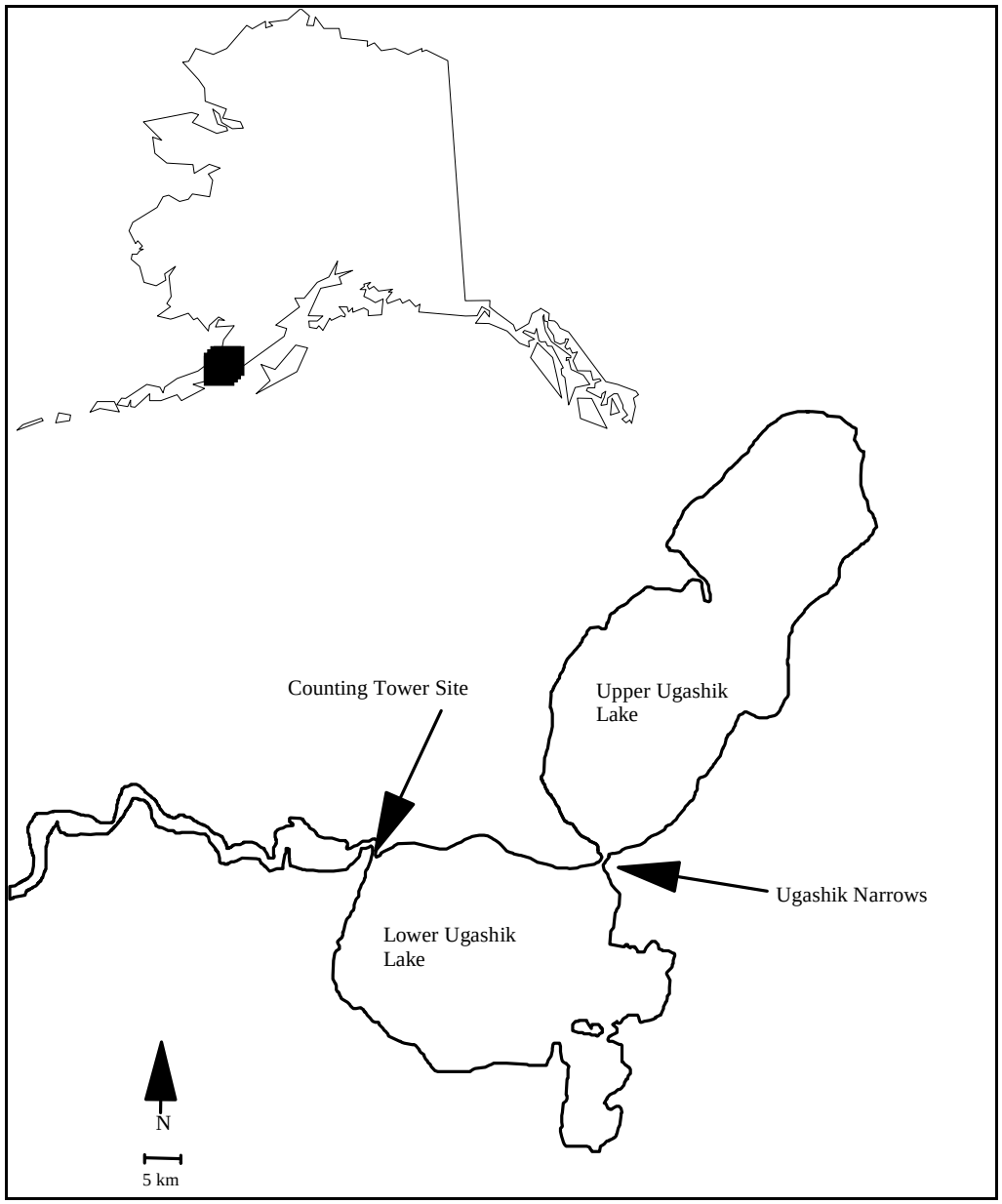

Figure 1. Location of coho salmon counting tower site on the Ugashik River, Alaska Peninsula National Wildlife Refuge, 2002

METHODS

Escapement Estimate

Counts of coho salmon at the Ugashik tower site were taken using the same equipment, location, and procedures used by the ADFG Commercial Fisheries Division to estimate sockeye salmon escapement in the drainage. Enumeration sampling followed the protocols established by the Department's Commercial Fisheries Division (Alaska Department of Fish and Game 1984). Counting towers and associated sampling methods have been used in the Bristol Bay area for several decades (Anderson 2000). Escapement is estimated by expanding 10-minute counts of fish passage made every hour of the calendar day for each bank of the river. The 10-minute counts are multiplied by an expansion factor of six to estimate passage for each hour. The 24 hourly estimates from each bank are then summed to provide daily passage estimates.

A light-colored metal panel was anchored to the river bottom near each bank to provide a contrasting background for optimal fish identification. Polarized sunglasses were worn by the crew to minimize glare off the water surface. Artificial lights were used to obtain counts during the night.

Age, Sex, and Length Data

A beach seine (30.5m long, 3.1m deep, and 7.6cm stretch mesh) was the primary gear used to capture salmon for collecting age, sex, and length data. Seining was conducted throughout the season at several locations near the counting tower until the sampling goal was achieved. Coho salmon lengths were measured from mid-eye-to-fork of the tail to the nearest millimeter and sex was determined by observing external characteristics (Mecklenburg et al. 2002). Three to four scale samples were collected from the preferred area (Jearld 1983) from each coho salmon sampled. Scale samples were cleaned and mounted on gum cards for making scale impressions. Scale impression were made on clear acetate with a laboratory press. Ages were interpreted from impressions independently by two researchers, and any conflicting age determinations were re-analyzed jointly until both researchers agreed on an age determination. Age designations were expressed in the European fashion (Koo 1962), where numerals preceding the decimal denote freshwater annuli, and numerals following the decimal refer to the marine annuli.

The sample size of 138 fish per week outlined in the original study plan was modified in 2002 to sample size of 61 for the season. This change was the result of data collected in 2001 which indicated the age/sex composition of the Ugashik lakes coho were very similar to other Bristol Bay stocks, therefore, to minimize our impact to the stock and to reduce project costs

the sampling scheme was changed. A staff biometrician from the Office of Subsistence Management developed the new sampling scheme based on the methods of Bromaghin (1993) where estimates of $\hat{\pi}$ for both age and sex were calculated using the same equation;

$$\hat{\pi} = \frac{n_i}{n} \quad \text{, where } I \text{ = age or sex} \tag{1.1}$$

confidence limits were calculated using the following equation;

$$\pi_i^- = \frac{z^2_{\left(1-\left(\alpha_i/2\right)\right)} + 2n_i - z_{\left(1-\left(\alpha_i/2\right)\right)}\sqrt{z^2_{\left(1-\left(\alpha_i/2\right)\right)} + 4n_i\left(\frac{n-n_i}{n}\right)}}{2\left(n + z^2_{\left(1+\left(\alpha_i/2\right)\right)}\right)} \tag{1.2}$$

$$\pi_i^+ = \frac{z^2_{\left(1-\left(\alpha_i/2\right)\right)} + 2n_i + z_{\left(1-\left(\alpha_i/2\right)\right)}\sqrt{z^2_{\left(1-\left(\alpha_i/2\right)\right)} + 4n_i\left(\frac{n-n_i}{n}\right)}}{2\left(n + z^2_{\left(1+\left(\alpha_i/2\right)\right)}\right)} \tag{1.3}$$

RESULTS

Escapement Estimate

Salmon counting began at 00:00 hours on 26 July 2002 and continued hourly through 23:00 hours on 24 September 2002. During this time there were nine days during which less than five coho salmon were counted (Appendix 1). The majority of these days occurred during the last week the tower was in operation. There was also one day (20 September) during which more coho salmon were counted passing the site traveling downstream rather than upstream, which resulted in a negative value for the escapement estimate on that day.

Total estimated coho salmon escapement into the Ugashik lakes during the study was 17,730 (Figure 2, Appendix 1). Daily estimated escapements range from 1,494 coho salmon on 25 August to -18 coho salmon on 8 August. The estimated average passage rate for the study

period was 290 ± 77 coho salmon per day. Other species of salmon were also counted as they passed the tower site. Total estimates for these species during the study were 21,270 sockeye salmon, 912 chum salmon *O. keta*, 132 chinook salmon *O. tshawytscha*, and 714 pink salmon *O. gorbuscha* (Appendix 1).

Age, Sex, and Length Data

We captured 66 coho salmon during the season (Table 1). While three age classes occurred in the samples, age 2.1 coho salmon comprised 71% of the total sample. Of the 55 readable scales, age 1.1 coho salmon comprised 27%, and age 3.1 coho salmon comprised 2% of the total sample.

Lengths of coho salmon samples ranged from 452 to 663 mm, and 80% of all coho salmon samples were less than 640 mm (Figure 3). Mean length for age 2.1 coho salmon was 590 mm, 581 mm for both 1.1 and 3.1 ages (Table 2).

Table 1. Estimated sex composition, mid-eye-fork length, and 90% confidence intervals (CI) of coho salmon sampled in the Ugashik lakes, Alaska Peninsula National Wildlife Refuge, 2002.

Sex	n	Percent	90% CI Range	Mean length mm	90% CI Range
Female	26	39	27-52	598	518-615
Male	40	61	48-74	572	553-591

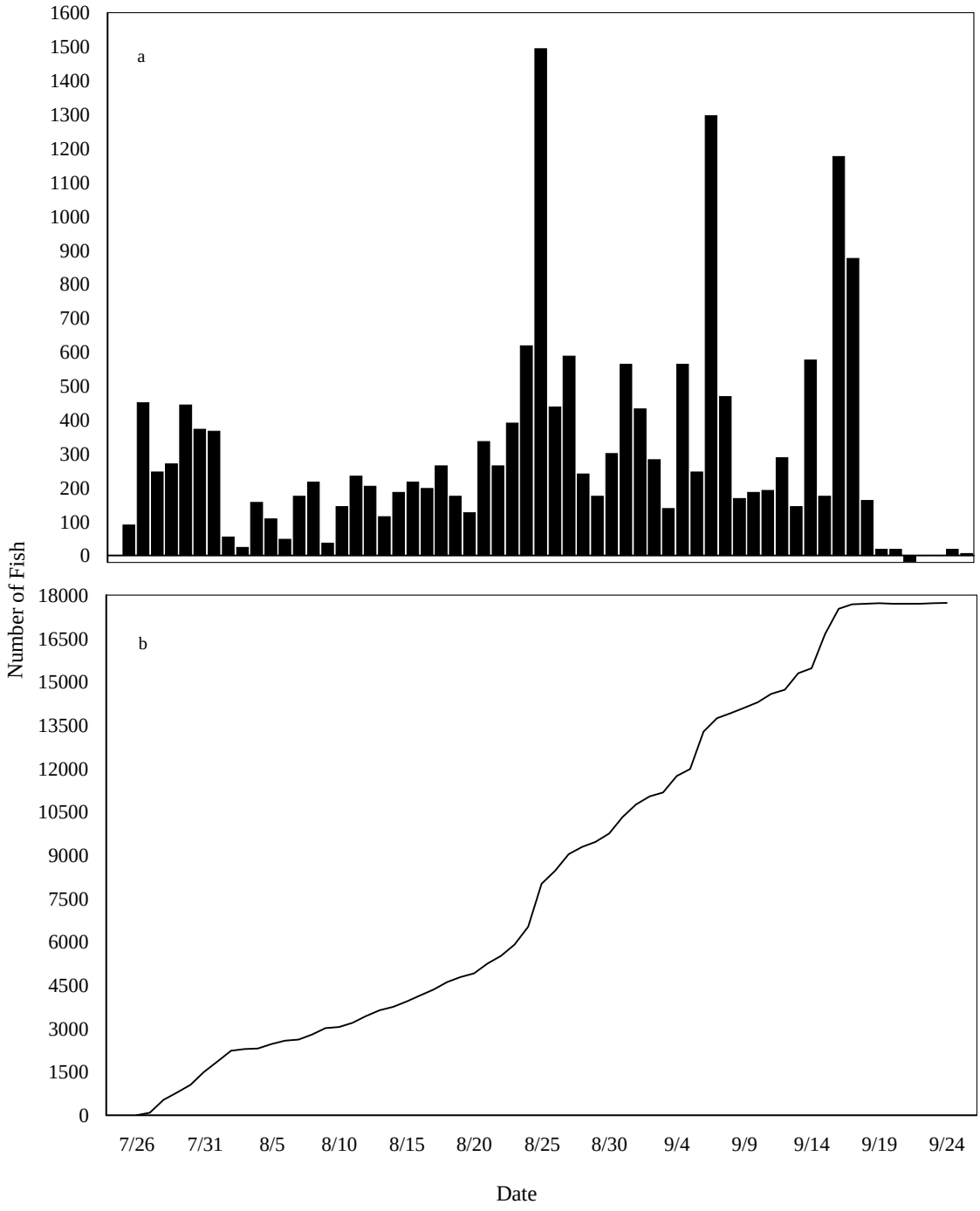

Figure 2. Estimated daily (a) and cumulative escapement (b) of coho salmon into the Ugashik lakes, Alaska Peninsula National Wildlife Refuge, 2002.

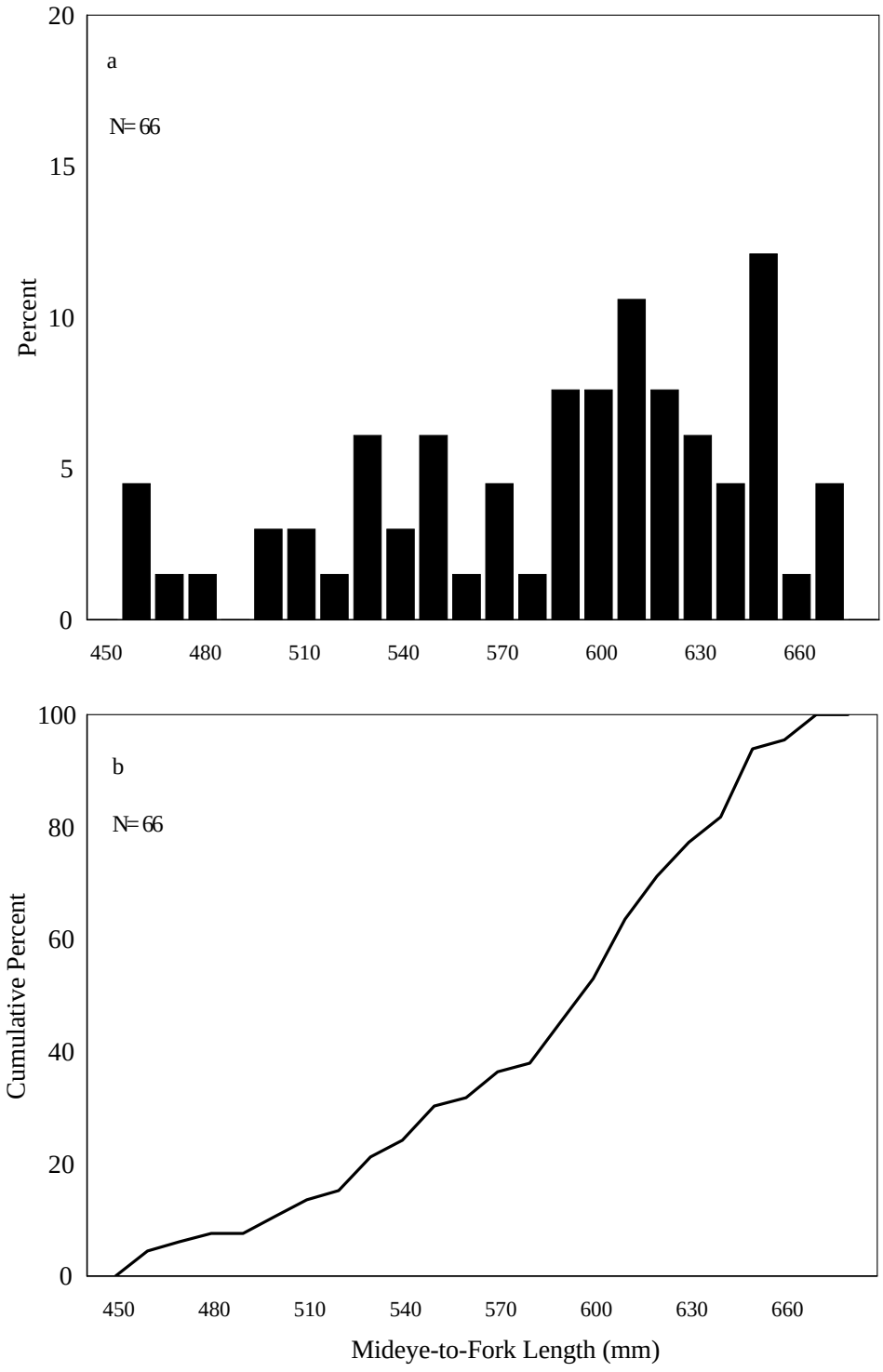

Figure 3. Length frequency (a) and cumulative length frequency (b) of coho salmon sampled in the Ugashik lakes, Alaska Peninsula National Wildlife Refuge, 2002.

Table 2. Estimated age composition, mid-eye-fork length, and 90% confidence intervals (CI) of coho salmon sampled in the Ugashik lakes, Alaska Peninsula National Wildlife Refuge, 2002.

Age	n	Percent	90% CI Range	Mean length mm	90% CI Range
1.1	15	27	17-41	581	551-611
2.1	39	71	57-82	590	560-620
3.1	1	2	0.3-11	581	------

DISCUSSION

Escapement Estimate

We believe our counting period encompassed most of the coho salmon run entering the Ugashik lakes to spawn. This assumption appears to be supported by distribution of counts over the season: no coho salmon were counted by the ADFG crew prior to our counts. Only one day of counting was missed between the sockeye salmon counts by ADFG and when dedicated coho salmon counts began on midnight, September 25. In addition, coho salmon counts were infrequent or absent during the last seven days of operations. Studies of other Bristol Bay systems, such as the Egegik (Russell 1996 and Weiland 1996) and Kulukak (Price and Larson 1999) systems, also suggest that our study began early enough to monitor the beginning of the coho salmon run. However, none of these studies were continued late enough into the season to determine when coho salmon runs ended.

The estimated escapement of 17,730 coho salmon into the Ugashik lakes was higher than the 2001 estimate of 3,606 coho salmon, and was more aligned with our preseason expectations of an escapement range of 10,000 to 15,000. Preseason expectations were based on coho salmon runs in the Becharof Lake system where coho salmon runs have been documented between 7,000 and 24,000 (Russell 1996 and Weiland 1996). The Becharof system is similar in rearing and spawning habitat and geographically close to the Ugashik lakes.

The 2002 estimated escapement was much higher than ADFG's 2,400 index average for the Ugashik lakes (Keith Weiland, ADFG Personal Communication). The 2002 ADFG aerial survey conducted on 21 September counted 1,505 coho salmon in the two Ugashik lakes and an additional 750 fish in the Ugashik River below the counting tower. Price and Larson (1999) found aerial estimates as likely to over as under estimate escapement estimates derived from tower counts and the correlation between the two methods was weaker for coho salmon than other salmon species.

Various sources of error are involved in estimating escapements from tower counts, e.g., observer error, visibility, salmon passage variation within each hour, and the proportion of the run available to observers. Some of these sources of error can be examined using video technology (Irvine et al 1991; Hiebert et al. 2000; Otis and Dickson 2001). Comments from local residents and the tower crew in 2001 lead us to question the accuracy of tower counts in estimating coho salmon escapement in the Ugashik lakes. Although counting towers have been shown to produce accurate salmon escapement estimates of large salmon runs (Anderson 2000), this may not be true for runs of only a few thousand salmon. In 2002 we investigated the accuracy of tower estimates of coho salmon escapement in the Ugashik lakes. We examined 152 hours digital video to compare the video count to the corresponding tower count and found the tower estimates to be within approximately 10% of video count (Edwards 2003 in review). Given the amount of variation in the counting process, we feel that tower counts are providing an estimate of coho salmon escapement in the Ugashik lakes at an acceptable level of accuracy for our management needs.

The 2001-02 tower counts have provided a baseline index of coho salmon escapement of into the Ugashik lakes. This baseline index can provide the Federal Subsistence Board with information needed to make informed decisions concerning subsistence issues within the Ugashik lakes. Final evaluation of the 2001-02 escapement estimates can only be accomplished upon completion of this project when additional yearly counts have been collected.

Age, Sex, and Length Data

The 2002 age composition of the Ugashik coho salmon run was similar to 2001. In both years, age 2.1 coho salmon were the most abundant age class followed by age 1.1 fish. Age composition of coho salmon sampled in this project was similar to that estimated for the Egegik (Russell 1996), Kulukak (Price and Larson 1999) and Nushagak (West and Gray 2001) rivers in Bristol Bay.

The estimated male-female sex ratio of the 2002 Ugashik coho salmon run was 1.5:1 (Table 1) was within the range of sex ratios reported for other stocks of coho salmon in Alaska (Sandercock 1991). Sandercock (1991) also reports some coho salmon runs in Alaska exhibit a greater abundance of males to females throughout the run, whether or not the sex ratio of the Ugashik lakes coho salmon run is skewed in uncertain. However, size selection by commercial fishing does not appear to be a factor in the sex ratio observed in the 2002 sample. Limited commercial fishing effort (three permits) occurred throughout most of the coho salmon run and resulted in 464 coho salmon harvested (Keith Weiland, ADFG Personal Communication).

The length data obtained in 2002 combined with the data from 2001 provides a baseline needed to detect any changes in the characteristics of this stock in the future. However, it is unclear what characteristics are representative of the historical composition, those of 2001-02 or future characteristics.

CONCLUSIONS

Escapement of coho salmon into the Ugashik lakes in 2002 was slightly higher than we expected and appears to be meeting current subsistence needs. Whether or not the escapement observed in 2002 is representative of historical escapement or an unusually high escapement is unknown at this time. Further escapement data is needed to determine the biological significance of the escapement estimate of 2002. The age, length, and sex composition was similar to that observed for other stocks of coho salmon in the Bristol Bay area.

RECOMMENDATIONS

The following recommendations are offered for the next two years of this study:

1 Continue the use of video technology to validate tower counting methods for coho salmon.

2. Extend the tower project for an additional three years to obtain escapement estimates that represent at least one complete brood cycle.

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LITERATURE CITED

Alaska Department of Fish and Game. 1984. Division of Commercial Fisheries. Escapement enumeration tower operational plan, 1984. Dillingham, Alaska.

Anderson, C.J. 2000. Counting tower projects in the Bristol Bay Area, 1955-1999. Division of Commercial Fisheries, Alaska Department of Fish and Game, Anchorage, Alaska, Regional Information Report 2A00-08.

Bromaghin, J. F. 1993. Sample size determination for interval estimation of multinomial probabilities. The American Statistician 47: 203-206.

Glick, W.J., J.B. Browning, S. Morstad, K.A. Weiland, and C.J. Anderson. 2000. Annual Management Report, 1999, Bristol Bay. Division of Commercial Fisheries, Alaska Department of Fish and Game, Anchorage, Alaska, Regional Information Report 2A2000-xx.

Hiebert, S., L.A. Helfrich, D.L. Weigmann, and C. Liston. 2000. Anadromous salmonid passage and video image quality under infrared and visible light at Prosser Dam, Yakima River, Washington. North American Journal of Fisheries Management 17:461-466.

Howe, A.L., R.J. Walker, C. Olnes, G. Heineman, and A.E. Bingham. 1999. Harvest Catch, and participation in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-41.

Irvine, J.R., B.R. Ward, P.A. Teti, and N.B.F. Cousens. 1991. Evaluation of a method to count and measure live salmonids in the field with a video camera and computer. North American Journal of Fisheries Management 11:20-26.

Jaenicke, M.J. and R.C. Squibb. 2000. Survey of the sport fishery at Ugashik Narrows, 1998. Division of Sport Fisheries, Alaska Department of Fish and Game, Anchorage, Alaska, Fishery Data Series No. 00-11.

Jearld, A. 1983. Age determination. Pages 301-324 *in* L. A. Nielsen and D. L. Johnson, editors. Fisheries techniques. American Fisheries Society, Bethesda, Maryland.

Koo, T.S.Y. 1962. Age designation in salmon. Pages 301-324 *in* T.S.Y. Koo, editor. Studies of Alaska red salmon. University of Washington Press, Seattle, Washington.

Mecklenburg, C. W., T. A. Mecklenburg, and L. K. Thorsteinson. 2002. Fishes of Alaska. American Fisheries Society, Bethesda, Maryland.

Otis, E.O., and M. Dickson. 2001. Improved salmon escapement enumeration using remote video and time-lapse recording technology. Exxon Valdez Oil Spill Restoration draft final report (restoration project 01366), Alaska Department of Fish and Game, Division of Commercial Fisheries, Homer, Alaska. 36pp.

Price, M. and J. Larson. 1999. Abundance and run timing of chinook, chum, coho, pink, and sockeye salmon in the Kulukak River, Togiak National Wildlife Refuge, Alaska, 1994-1996. U.S. Fish and Wildlife Service, King Salmon Fishery Resource Office, Alaska Fisheries Technical Report 52, King Salmon, Alaska.

Russell, R. B. 1996. Coho salmon escapement counts in the Egegik district, Bristol Bay, Alaska 1995. Division of Commercial Fisheries, Alaska Department of Fish and Game, Anchorage, Alaska, Regional Information Report 2A96-04.

Sandercock, F. K., 1991. Life history of coho salmon. Pages 397-445 *in* C. Groot and L. Margolis editors. Pacific salmon life histories. University of British Columbia Press, Vancouver British Columbia.

Sands, T., Morstad, S., K.A. Weiland, J. B. Browning, and C. J. Anderson. 2002. Annual Management Report, 2000, Bristol Bay Area. Division of Commercial Fisheries, Alaska Department of Fish and Game, Anchorage, Alaska, Regional Information Report 2A02-18.

Weiland, K. A. 1996. Coho salmon escapement counts in the Egegik district, Bristol Bay, Alaska 1996. Division of Commercial Fisheries, Alaska Department of Fish and Game, Anchorage Alaska, Regional Information Report 2A96-38.

West, F. W. and D. C. Gray. 2001. Abundance, age, sex, and size statistics for Pacific salmon in Bristol Bay, Alaska, 1999-2000. Division of Commercial Fisheries Alaska Department of Fish and Game, Anchorage Alaska, Regional Information Report No. 2A01-29

Wright, J.M., J.M. Morris, and R. Schroeder. 1985. Bristol Bay Regional Subsistence Profile, Division of Subsistence, Alaska Department of Fish and Game, Dillingham, Alaska, Technical Paper No. 114.

Appendix 1. Daily salmon counts and estimated cumulative escapement into the Ugashik lakes system Alaska Peninsula Wildlife Refuge, 2002.

	2002 Daily Counts					2002 Cumulative Estimated Escapement				
Date	sockeye	coho	chum	chinook	pink	sockeye	coho	chum	chinook	pink
July 26	258	0	0	1	0	1,548	0	0	6	0
27	284	15	1	5	0	3,252	90	6	36	0
28	133	75	0	1	0	4,050	540	6	42	0
29	634	41	1	-3	7	7,854	786	12	24	42
30	473	45	2	3	18	10,692	1,056	24	42	150
31	291	74	2	2	34	12,438	1,500	36	54	354
Aug. 1	86	62	5	0	4	12,954	1,872	66	54	378
2	343	61	2	2	21	15,012	2,238	78	66	504
3	497	9	6	6	2	17,994	2,292	114	102	516
4	138	4	7	0	0	18,822	2,316	156	102	516
5	109	26	3	1	0	19,476	2,472	174	108	516
6	35	18	4	0	1	19,686	2,580	198	108	522
7	23	8	6	0	2	19,824	2,628	234	108	534
8	151	29	15	1	2	20,730	2,802	324	114	546
9	51	36	6	0	2	21,036	3,018	360	114	558
10	-79	6	3	0	0	20,562	3,054	378	114	558
11	67	24	16	0	0	20,964	3,198	474	114	558
12	16	39	11	0	0	21,060	3,432	540	114	558
13	22	34	4	1	1	21,192	3,636	564	120	564
14	3	19	12	0	2	21,210	3,750	636	120	576
15	3	31	10	0	1	21,228	3,936	696	120	582
16	2	36	17	0	4	21,240	4,152	798	120	606
17	0	33	2	2	4	21,240	4,350	810	132	630
18	1	44	1	0	2	21,246	4,614	816	132	642
19	0	29	2	0	3	21,246	4,788	828	132	660
20	0	21	0	0	2	21,246	4,914	828	132	672
21	0	56	0	0	1	21,246	5,250	828	132	678
22	0	44	0	0	0	21,246	5,514	828	132	678
23	0	65	1	0	1	21,246	5,904	834	132	684
24	0	103	2	0	0	21,246	6,522	846	132	684
25	1	249	1	0	0	21,252	8,016	852	132	684
26	0	73	7	0	0	21,252	8,454	894	132	684
27	0	98	0	0	2	21,252	9,042	894	132	696
28	0	40	1	0	1	21,252	9,282	900	132	702
29	0	29	0	0	1	21,252	9,456	900	132	708
30	0	50	0	0	0	21,252	9,756	900	132	708
31	0	94	0	0	0	21,252	10,320	900	132	708
Sept. 1	0	72	0	0	0	21,252	10,752	900	132	708
2	0	47	0	0	0	21,252	11,034	900	132	708
3	0	23	0	0	0	21,252	11,172	900	132	708
4	0	94	0	0	0	21,252	11,736	900	132	708
5	0	41	0	0	0	21,252	11,982	900	132	708
6	0	216	0	0	0	21,252	13,278	900	132	708
7	0	78	0	0	1	21,252	13,746	900	132	714
8	3	28	0	0	0	21,270	13,914	900	132	714
9	0	31	0	0	0	21,270	14,100	900	132	714

Appendix 1. Continued

	2002 Daily Counts					2002 Cumulative Estimated Escapement				
Date	sockeye	coho	chum	chinook	pink	sockeye	coho	chum	chinook	pink
Sept. 10	0	32	0	0	0	21,270	14,292	900	132	714
11	0	48	0	0	0	21,270	14,580	900	132	714
12	0	24	0	0	0	21,270	14,724	900	132	714
13	0	96	0	0	0	21,270	15,300	900	132	714
14	0	29	0	0	0	21,270	15,474	900	132	714
15	0	196	2	0	0	21,270	16,650	912	132	714
16	0	146	0	0	0	21,270	17,526	912	132	714
17	0	27	0	0	0	21,270	17,688	912	132	714
18	0	3	0	0	0	21,270	17,706	912	132	714
19	0	3	0	0	0	21,270	17,724	912	132	714
20	0	-3	0	0	0	21,270	17,706	912	132	714
21	0	0	0	0	0	21,270	17,706	912	132	714
22	0	0	0	0	0	21,270	17,706	912	132	714
23	0	3	0	0	0	21,270	17,724	912	132	714
24	0	1	0	0	0	21,270	17,730	912	132	714